A Closer Look at Fannie Mae and Freddie Mac:

What We Know, What We Think We Know and What We Don't Know

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Abstract

We explore the role of housing policy in the collapse of Fannie Mae and Freddie Mac, the role of Fannie and Freddie in subprime markets and the sources of their default losses. We do not find evidence that their crash was due much to government housing policy or that they had an essential role in the development of the subprime mortgage-backed securities market, which occurred outside of the normal mortgage origination channels and which was funded by non agency or "private label" securities (PLS). They did build a large portfolio of AAA-rated PLS, probably in response to affordable housing goals, but such investments were unlikely to have had much of an impact on subprime mortgage origination volume because the AAA pieces of PLS deals were not key to their completion. Nor were PLS a major part of their losses. Rather than brewing for a long time, their downfall was quick, primarily due to mortgage originated in 2006 and 2007. It had little to do with their much-criticized portfolios, and was mostly associated with purchases of risky-but-not-subprime mortgages and insufficient capital to cover the decline in property values.

I. Introduction

On September 7, 2008, the Federal Housing Finance Agency (FHFA), in conjunction with the Treasury Department and the Federal Reserve Board of Governors, placed Fannie Mae and Freddie Mac (the Government-Sponsored Enterprises or "GSEs") into conservatorship. This was a major turnaround for two companies that had been highly profitable. Until then Fannie and Freddie had experienced default losses (charge-offs) that were generally less than five hundredths of a percent per year and default rates less than half those of the rest of the industry.

Fannie and Freddie are a very big part of the mortgage market, owning some $5 trillion in mortgages and mortgage-backed securities with a correspondingly large level of debt, which investors assumed (correctly it turns out) was guaranteed by the government. Costs have been large. From 2008 through the second quarter of 2010 they lost $226 billion in capital, $148 of which has been covered by capital injections from the government and $78 billion of which was their own capital in 2008. There will likely be more losses. At roughly 1% of 2010 U.S. GDP, Treasury preferred stock purchases to date have been in the range of taxpayer losses experienced during the Savings & Loan crisis.

Given the magnitude of the losses at the GSEs and the fact that the financial crisis seemed to have its origins in the residential housing finance market, some policymakers and commentators have suggested that the GSEs bear much of the responsibility for the financial crisis (cf. Greenspan, 2010, Wallison, 2008, Wallison and Calomiris, 2008, House Committee on the Budget, 2009, among others). This narrative tends to put particular emphasis on "affordable housing goals" that the GSEs were required to meet pushing them into taking on excessive risk and into making the market in subprime loans (e.g., Rajan (2010)). That Fannie and Freddie required an expensive taxpayer-financed rescue just years after they were identified as posing a systemic risk is consistent with this line of reasoning.

That narrative is not, however, well supported by data we have so far. We use data provided by the FHFA, Fannie Mae and Freddie Mac's annual reports, monthly volume summaries, and quarterly credit supplements, as well as Loan Performance data collected by the General Accounting Office (GAO) to explore the changes in the mortgage market and nature of the GSEs' holdings. We find that the growth of the subprime mortgage market was largely a non-GSE phenomenon: it occurred outside of the normal mortgage origination channels and was funded by nonagency or "private label" securities (PLS). The GSEs did build a large portfolio of AAA PLS, probably in response to affordable housing goals, but such investments were unlikely

to have had much of an impact on subprime mortgage origination, and they were not a large share of their credit losses. Nor were their losses due to their much criticized mortgage and mortgage-backed security portfolios, which were mostly about interest rate risk, which was not a problem.

The GSEs did ramp up risk-taking, but mostly not for "goals-related" reasons and mostly as a part of their regular securitization business. Their increased risk-taking was in "nontraditional" loans that were not especially goals rich, and they lagged behind the market with respect to loans made to targeted communities. They did not purchase nontraditional mortgages in any quantity until the U.S. homeownership rate had already peaked in 2005. The bulk of nontraditional mortgages the GSEs did acquire or guarantee after 2005 were not "subprime," but largely "Alt-A" and interest-only mortgages that were made to borrowers with "prime" credit scores and relatively sizeable equity contributions, on average.

Their losses were due to a switch to riskier loans to get back market share and to not having enough capital to survive the crash in property values. We do not have sufficient data to assess relative importance of the two in detail, but indirect evidence suggests both were very important. 2007 was an especially bad origination both because of price declines, but also because loans originated that year were on the order of three times more likely to default even after controlling for observable underwriting and price declines.

II. Recent History

Between 1990 and 2000, total household mortgage debt increased at a 6.8% annualized rate, while the growth in the dollar value of home mortgages financed by the GSEs grew about one-third faster, at 9% per year. By 2003, Fannie Mae and Freddie Mac accounted for 52.3% of all residential mortgage loans outstanding (Federal Reserve and Monthly Funding Summaries). The following year, GSE market share of newly originated mortgages fell precipitously and remained low for the next three years: during 2001-2003, the GSEs funded nearly 70% of all mortgages originated; from 2004-2006, the GSE share of new mortgages was 47%, 41%, and 40%, respectively (see Table 1).

(INSERT TABLE 1 HERE)

From 2003 to 2007, the growth of outstanding mortgage debt accelerated to 11.9% per year but the volume of outstanding mortgages financed by the GSEs rose by just 7.6% per year. On a cumulative basis, the overall mortgage market grew 31% faster than the volume of mortgages funded by the GSEs over this period. This shift involved two related developments: (1) the share of total outstanding mortgage debt financed by the issuance of "nonagency" or "private label" asset-backed securities (PLS) grew by 219% over this period; and (2) the origination of non-traditional mortgage products, like subprime (generally poor credit history and other negative attributes like low downpayments and less than full documentation) and Alt-A loans (seemingly prime but with a flaw, typically low documentation) that might not normally meet GSE underwriting criteria also grew rapidly. These factors were associated with the share of total mortgages financed by the GSEs falling from 52% at the end of 2002 to 44% at the end of 2006 (See Chart 1).

(INSERT CHART 1 HERE)

In 2000, securitization vehicles (entities classified as asset-backed security issuers and finance companies by the Federal Reserve) financed $572 billion in residential mortgages, equal to nearly 12% of all household mortgage debt outstanding. By the end of 2006, the volume of outstanding mortgages financed by PLS had grown to over $2.6 trillion, or more than 27% of all residential mortgage debt. The most explosive growth occurred in 2004 and 2005 when the outstanding mortgage debt financed by PLS increased by 49% and 44% respectively. It is important to note that these growth rates reflect net annual changes in total mortgage debt; when refinancings of existing PLS-funded mortgages are included, the growth rates on gross PLS issuance during these years exceed 90%.[1]

The dramatic growth in PLS issuance was the capital markets' manifestation of the increase in the origination of nontraditional mortgage products outside of the GSE channel. According to the Government Accounting Office (GAO), "nonprime" mortgage loans (subprime plus Alt-A) accounted for 34% of the overall mortgage market in 2006. From 2001 to 2005, the dollar volume of subprime mortgages increased from $100 billion to $600 billion, while Alt-A mortgages grew from $25 billion to $400 billion over roughly the same period. As with the growth in PLS outstanding, the volume of subprime and Alt-A mortgage origination increased most dramatically in the middle of the decade. Combined annual subprime and Alt-A origination grew from an estimated $171 billion in 2002 to $877 billion in 2005, an annualized growth rate of 72%.

[1] Subprime mortgages, in particular, prepay quite rapidly so there are important differences between the flow of originations and the stock of mortgages between prime and subprime.

(INSERT CHART 1 HERE)

III. Fannie and Freddie PLS Portfolios

The growth of the nontraditional mortgage market was largely a non-GSE phenomenon in that it occurred outside of the normal origination channels and was financed by the issuance of nonagency securities (Meyer, Pence, & Sherlund, 2009). However, both Fannie Mae and Freddie Mac were major buyers of these securities. Fannie and Freddie acquired large amounts of subprime PLS because, in the words of their regulator, these securities were "goals rich" (Lockhart, 2009). They were required to meet affordable housing goals, set annually by the Department of Housing and Urban Development (HUD) in accordance with The Federal Housing Enterprises Financial Safety and Soundness Act of 1992. The purchase of PLS backed by subprime mortgages counted toward meeting these goals because the underlying mortgages tended to be made to less-than-median-income borrowers or were collateralized by properties in "underserved areas" (HUD, 2010). Some deals were set up with loans that were chosen to be goals-rich.

(INSERT TABLE 2 HERE)

In testimony before the Financial Crisis Inquiry Commission (FCIC), former Federal Reserve Chairman Alan Greenspan (2010) argued that it was the supportive bid provided by the GSEs for subprime PLS during 2003-2004 that caused mortgage yields to fall relative to 10-year Treasury notes, "exacerbating the house price rise which, in those years, was driven by interest rates on long-term mortgages." Because these purchases were made in pursuit of affordable housing goals, Greenspan argues "a significant proportion of the increased demand for subprime mortgage backed securities during the years 2003-2004 was effectively politically mandated, and hence driven by highly inelastic demand." By acquiring 40% of all PLS collateralized by subprime mortgages, Fannie and Freddie stoked demand for risky mortgages that contributed directly, in Greenspan's telling, to the housing bubble and subsequent financial crisis. Similar points were made in Rajan (2009).

(INSERT CHART 2 HERE)

The data support Greenspan's claims regarding the size of the GSEs' PLS purchases (see Chart 2), In 2003-2004, Fannie and Freddie combined to purchase an estimated $214 billion in subprime PLS, or roughly 40% of all subprime securities issued, which represents more than a three-fold increase over the amount of subprime PLS purchased in 2001-2002. GSE purchases

generally hovered around 30% of the subprime market for much of the decade until the market collapsed in 2007. However, the data do not support the rest of his thesis

While the sheer magnitude of GSE purchases would seem to provide an important source of demand for subprime loan collateral, this was unlikely the case due to the specific type of securities purchased. A typical PLS involves a "waterfall" payment structure. Instead of a traditional "pass-through," the PLS note holders are paid according to their seniority, with senior pieces or *tranches* getting paid first and suffering losses from defaults on the underlying collateral, if any, last. The size of the tranches is chosen to achieve AAA ratings on the senior portion(s), with the amount of subordinated securities adjusted as necessary to provide the overcollateralization required by rating agencies.

Fannie and Freddie bought almost nothing but AAA rated tranches. According to Freddie Mac's 2006 Annual Report, "more than 99.9 percent" of its PLS were rated AAA. Until 2007, Fannie Mae also bought exclusively AAA PLS and added only "limited amounts" of other investment grade PLS in 2007 (Fannie Mae, 2007). The tranches were senior in the risk queue to junior pieces, typically 20% of the pool, which absorbed first losses. Their investments were roughly equivalent to direct investments with 20% capital cushions. AAA tranches received principle payments before other tranches, so they were shorter term.

That the GSEs invested in AAA tranches is significant because it largely undercuts claims that their purchases had a significant effect on subprime mortgage origination or the pricing of these securities. A common theme among research that has examined the causes of the financial crisis is the "insatiable demand" that existed for safe, dollar-denominated debt. Acharya and Richardson (2009) emphasize that securitization existed to create AAA tranches, which appealed to many classes of potential investors. As explained by Brunnermeier (2009), some of those investors were money market and pension funds limited by law or investment policy to invest only in AAA assets, while others were leveraged hedge funds attracted to AAA securities because of their low haircuts and potential for greater leverage (Shleifer and Vishny, 2009).

A major source of demand for AAA assets came from foreign institutional investors. Caballero (2010, 2009) argues that global payment imbalances were the manifestation of "global excess demand" for AAA securities that placed "enormous pressure on the U.S. financial system and its incentives." Similarly, Gourinchas (2010) argues that excess demand for AAA assets "created an irresistible profit opportunity for the U.S. financial system" to create and market "safe" asset-backed securities to the rest of the world. Diamond and Rajan (2009) find that "securitization became focused on squeezing out the most AAA paper from an underlying package of

mortgages" because, according to Gorton and Metrick (2009), "there is not enough AAA debt in the world to satisfy demand." Hull (2009) offers the same critique. Indirect evidence of strong demand can be found in the market for synthetic securities that mimicked the returns of actual ones, because there were not enough actual ones to sell.

Given this context and the apparently elastic demand for seemingly homogeneous AAA securities, it is difficult to believe GSE purchases of AAA tranches of subprime PLS had any material impact on pricing or issuance volume. To acquire AAA subprime PLS, the GSEs issued agency debt, another AAA instrument. Thus, the net effect of these acquisitions was to leave the global supply of AAA rated securities unchanged.

It is also important to note that the duration of the top tranches of these securities was exceptionally short. As Gorton (2008) explains, the expectation was for the underlying mortgage collateral to be refinanced in two years with any amortization of principal prior to the refinancing generally directed to the AAA tranches purchased by the GSEs. Although Fannie and Freddie combined to purchase nearly $600 billion of subprime PLS between 2000 and 2007, their combined holdings of subprime PLS did not likely exceed $200 billion at any given time. At the end of 2008, the GSEs reported combined subprime PLS holdings of $154.6 billion, another $62.5 billion of Alt-A PLS, and $19 billion of residential mortgage PLS not otherwise classified.

The key to the completion of the PLS market was identifying a purchaser for the risky and illiquid junior pieces that provided the subordination to support the AAA rating on the senior tranches. Some of the bids for junior pieces were provided by hedge fund managers who preferred their illiquidity both because of the profit opportunity provided by valuation challenges and because thin trading provides the manager with some flexibility with respect to fair values (Brunnermeier, 2009). The other major source of funding for these tranches came from collateralized debt obligations (CDOs), which sought ABS collateral because of the discount to like-rated corporate bonds (Moody's, 2000).

More significantly, CDOs provided a mechanism to transform junior tranches of PLS into additional AAA securities to meet "insatiable" global demand. The data show that the share of junior tranches sold directly to investors declined over the period, suggesting that more of these tranches were purchased by CDO managers (Thomson Reuters, 2010). Neither GSE acquired junior pieces of securitizations or had any exposure to CDOs (Fannie Mae, 2007, p. 97;

Lockhart, 2008). Fannie and Freddie could not use CDOs for goals credit. On the importance of the CDO market to the completion of PLS deals see Mason and Rosner (2007).

Like all investors in subprime PLS, the GSEs suffered large mark-to-market losses on these positions. Roughly 90% of PLS held in GSE portfolios suffered credit rating downgrades (FHFA, 2010). In 2008, Fannie Mae and Freddie Mac suffered a combined $84 billion of losses on portfolio investments (including losses on derivatives used to hedge assets or liabilities). While $24 billion reflected permanent impairments on PLS, much of the rest reflected temporary fair value losses caused by unusually depressed market conditions. While the exceedingly high default rates on subprime and Alt-A mortgages have eviscerated most of the protection provided by subordination and overcollateralization, the ultimate losses to the AAA tranche need not be particularly large. Loss rates of 15% erode the economic value of a AAA tranche that once had 20% overcollateralization but do not diminish ultimate payments to the note holder unless things get even worse.

Both GSEs have written up the value of their investment portfolios by a combined $62 billion in 2009-2010. By the estimates of the FHFA, losses on PLS investments and derivatives have accounted for $21 billion or just 9% of total GSE losses (net of income from the securities) since the end of 2007; losses on subprime PLS (*not* net of income from the securities) were $18 billion, or about 10% of overall portfolio credit losses.[2] This suggests that the subprime PLS business has (net) accounted for around 5% of their losses. Losses on all subprime PLS will probably be a few hundred billion dollars.

IV. Affordable Housing Goals

While the GSEs were likely attracted to the same extra yield on "safe" securities that made AAA PLS tranches attractive for other classes of investors, it seems reasonable to believe that affordable housing goals motivated these purchases. As explained by FHFA, PLSs were a major channel through which the GSEs fulfilled their affordable housing goals. They had high ratings and were seemingly well protected by subordination. They were goals intensive, and they were short term. Because the goals were set in terms of the flow purchases, rather the stock held, they could get credit for housing goals by what was essentially rolling over of the existing stock of what were essentially bridge loans. As a result they could buy 30% to 40% of the amount issued, but only hold around 15% of the outstanding stock.

[2] See Conservator Report (2010).

There are two possibilities for a firm's reaction to a regulatory constraint. One is that the constraint is not binding; Fannie and Freddie might have wanted to do goals-rich lending anyway, in which case the regulations were not causal. Alternatively they were constraining, in which case profit maximizing firms will try to find least cost ways of complying. AAA PLS by and large had high levels of subordination, typically 20%, which were consistent with 40% of the loans in the pool defaulting and recovery rates of only 50%. By historical standards those were very big losses. More recently, Hull and White (2010) have come to the conclusion that AAA ratings for ABS were not unreasonable; though that was not the case for AAA ratings of CDOs. A likely explanation for the growth of PLS holdings was a way of minimizing the costs of complying with the goals. The data are consistent with subprime PLS purchases by Fannie and Freddie being little more than reshuffling paper without changing what was originated.

PLS issuers assembled AAA tranches specifically for the GSEs that were targeted to satisfy specific goals and subgoals (FHFA, 2010). In 2007 (2006 10-K, page 16), Fannie Mae lamented the decline in subprime origination that year: "because subprime mortgages tended to meet many of the HUD goals and subgoals," the decline in subprime origination "has further limited our ability to meet these goals." Indeed, the collapse of the PLS market caused HUD in April 2008 to declare the low- and moderate-income and special affordable home purchase subgoals infeasible. FHFA took the same step in 2009 and as part of its 2010 goals rulemaking proposes to "exclude PLS from counting for purposes of the affordable housing goals." Affordable housing goals are now much less stringent, at least with respect to the overall goals and the home purchase subgoals.

Would the housing market have developed differently had these goals been less stringent? Of course, counterfactuals are tough, but it is unlikely. This is not only because demand for AAA securities would have continued to provide an incentive to securitize subprime mortgages, but also because the market's development was endogenous to the affordable housing goals themselves. That is, Fannie and Freddie were not leaders in share of low income lending. The growth of the subprime market caused the GSEs' mortgage portfolio to lag the market with respect to loans made to lower income borrowers, minorities, as well as loans made in underserved areas targeted by HUD (Case, Gillen, & Wachter, 2002).

The purpose of HUD's 2004 affordable housing goals was to close the gap "so that by 2008 [GSE purchases] would equal the projected shares of goal-qualifying units financed in the primary mortgage market." The 2004 affordable housing goals rule makes repeated reference to the GSEs' low market share for loans made to "affordable and low- and moderate-income borrowers and underserved neighborhoods" and also references a Congressional Budget Office

(CBO) report estimating that the "funding advantage" created by the implicit guarantee and explicit advantages of GSE status "resulted in a $19.6 billion annual combined subsidy for both GSEs" in 2003.

The message sent by the rule is that the GSEs do not deserve the special privileges afforded by their charter if they badly lag the "private market" with respect to funding affordable mortgages. Attributing the housing bubble to an exogenous shock introduced by overzealous regulators is simply wrong. The affordable housing goals clearly reflect a presumption that entities sponsored by the government should do as much to meet social goals as "purely private" purchasers and, in some cases, lead the market. To a large extent the goals were set to catch up with rest of the market. One can certainly argue that the goals were bad policy (an ineffective and inefficient way of providing a subsidy), but they were not the driver of the market. Had the subprime market not already developed, the goals would have been lower.

Further evidence of the relative unimportance of the goals is Jaffee (2010), who points out that: incentives were weak because when Fannie and Freddie fell short of their goals nothing happened, the goals prohibited many subprime products and Fannie and Freddie appeared to "cherry pick" among the set of eligible loans (Jaffee and Quigley (2007)). Jaffee too comes to the conclusion that the goals had little to do with losses.

Fannie and Freddie did ramp up risk-taking, but mostly not for "goals-related" reasons. Their increased risk-taking was in "nontraditional," especially Alt-A, loans that were not especially goals rich. Alt-A loans were generally les able to qualify for income-based affordable housing goals because they were often made to relatively affluent borrowers and typically lacked information on the borrower's income, the documentation of which is necessary to receive credit towards the goals. As explained in Weicher (2010), the lack of income and (in the case of rental units) rent documentation and HUD rules governing the inclusion of Alt-A mortgages in the goals calculations meant that the more Alt-A loans the GSEs acquired, the more difficult it became to meet the Low- and Moderate-Income Goal and the Special Affordable Goal.

That increases in Alt-A loan purchases made income-based goals more difficult to meet is supported by data reported in Wallison (2011). Data collected by the FCIC (reproduced in Table 13) show that the percentage of Alt-A loans acquired by Fannie Mae that counted towards the income-based affordable housing goals fell short of the required overall goals in each year between 2001 and 2008 (that was not true for location-based goals). If the percentage of Alt-A

loans that qualified for income goals was below the percentage of all loans required to be made to low-income borrowers, then increases in Alt-A lending had to be offset by increases in percentage of traditional mortgages that qualified for the income-based housing goals. If the marginal purchase of an Alt-A mortgage made the attainment of income-based housing goals less likely, one can safely conclude that the increase in Alt-A mortgage purchases after 2005 had nothing to do with housing policy.[3]

What explains the surge in risky loans if it was not the goals? Most likely, according to their regulator and testimony before the Crisis Commission, it was a decision to follow the market and buy back market share lost to private label securitization of both subprime and Alt-A loans from 2003 to 2005, when the Fannie/Freddie share of mortgage originations went from almost 60% to less than 40%. That surge was the main problem, and it was enabled by their guarantee, which allowed them to continue borrowing at low rates despite ramping up risk.

V. **Risk Characteristics of the GSE Credit Book**

A recent report by FHFA (FHFA (2010)) has dissected the deterioration in Fannie and Freddie capital since 2008. The deterioration has been $226 billion, $148 of which has been covered by capital injections from the government, and $78 billion was their own capital in 2008. The report also breaks down losses by loan type. The data are not perfect; they depend on estimates of future losses, which will be revised as actual losses differ from expected. But the results are sufficiently sharp to suggest that the story is likely to hold up.

According to FHFA, losses on mortgages purchased or guaranteed accounted for $166 billion, or 73%, of the GSEs' combined losses from the start of 2008 to the second quarter of 2010 (the remaining 18% of losses come from multifamily, dividends to Treasury, and accounting changes). The bulk of these losses have come from mortgages originated in 2006 and 2007, with 2007 having the nastiest characteristics. While mortgages from these vintages account for 34% of all mortgages guaranteed by the GSEs at year-end 2008, they have produced between 63% and 71% of cumulative credit losses. The increased share of "nontraditional and higher-risk mortgages" in these vintages is frequently blamed for the credit losses. Jaffee (2010) argues the "GSE high-risk mortgage purchases and guarantees" during this period "helped fuel the housing bubble and financial crisis." He cites data from Edward Pinto (2009) and the GSE credit

[3] It is the case (see Wallison) that Alt-A loans were strong in the location goals set for low income and minority census tracks. On balance the Alt-A loans hurt re the two low income goals and helped re the location goals. So at best there is little net effect. The location goals were probably less binding and could be made to relatively high income and nonminority borrowers if they lived in targeted census tracks. Hence, the connection with low income and minority borrowers is very tenuous.

supplements to argue that more than 40% of the loans acquired or guaranteed by the GSEs in 2004-2008 were "high risk." The combined losses on guaranteed mortgages are thought to be the manifestation of the large increase in the volume of "high risk" mortgages purchased during this period.

Although this is an easy explanation for the spike in credit losses, it is not immediately clear what makes certain categories of mortgages "high risk." Properties that deviate from those of "traditional" mortgages are unlikely to have the same marginal impact on default probabilities; for instance, it is not clear why interest-only loans should be put in the same risk bucket as low down payment or low credit score loans, or why the latter should be put into the same category as loans with both low down payment and low credit scores. We need something more informative than that about half of mortgage purchases had above average risk.

Furthermore, placing discrepant mortgages into a "high risk" bucket because of elevated *realized* default rates introduces hindsight bias that could compromise the validity of the causal relationship. Given the magnitude of the decline in house prices after 2006, anything originated around then was likely to have problems.

Evaluation of the GSEs' exposure to "high risk" mortgages requires the identification of those properties that give rise to high *ex ante* default probabilities rather than those properties shared by mortgages found to have high *ex post* credit losses.

(INSERT TABLE 3)

The most obvious and well-defined characteristics that heighten default probabilities are low FICO scores and high loan-to-value (LTV) ratios (Demyanyk and Hemert, 2009). As seen in Table 3, the share of loans purchased with low FICO scores (below 620) did not change measurably over the course of the decade. High LTV loans (loan balances greater than 90% of the value of the house being financed) also comprised a relatively low share of annual purchase volume; although high LTV loans guaranteed in 2007 were high relative to 2005, their share over the entire period shows no well-defined upward trend. The share of mortgages with both characteristic – i.e. high LTV loans made to borrowers of poor credit quality – was very small as a share of the GSEs' combined credit book (see Table 4). As of June 30, 2008 – the last financial disclosures made prior to conservatorship – the GSEs combined to hold $44 billion in such mortgages, equal to just 0.97% of their combined $4.5 trillion book of business (excluding PLS securities). When including high LTV loans made to borrowers with FICO scores above

620 ($379 billion) and lower LTV loans made to borrowers with lower FICO scores ($160 billion), the total volume of "high risk" mortgages is $582 billion or 12.9% of the overall credit book (again, refer to Table 4). It is also important to note that 93% of high LTV loans were credit-enhanced, which means that the loans either had primary mortgage insurance (which covers most but not all of the losses), an embedded put option, or some other feature that limits ultimate losses.[4]

(INSERT TABLE 4)

Of the remaining $3.921 trillion in mortgages guaranteed by the GSEs as of June 2008, $463 billion were "Alt-A." (Of the $497 billion Alt-A mortgage total, $34 billion were high LTV loans or low FICO loans otherwise captured in the data. A summary of the combined Alt-A portfolio is available in Table 12). As explained by Fannie Mae, an "Alt-A mortgage loan" generally refers to a mortgage loan that can be "underwritten with reduced or alternative documentation than that required for a full documentation mortgage loan but may also include other alternative product features." Alt-A loans were a "complementary product" that were sourced through "traditional lenders that largely specialize in originating prime mortgage loans" (Freddie Mac, 2007, p. 94). A question that requires further research is the extent to which losses were due to "flow" purchases of new mortgages or "bulk" purchases of seasoned loans.

The risk posed by an Alt-A loan is difficult to parameterize because it concerns the economic value of the incremental private information unknown at the time the mortgage is purchased. This risk was thought to be attenuated by relationships with "traditional lenders" and more conservative underwriting with respect to the available information, e.g., on LTV and credit score. Relative to the overall credit book, Alt-A mortgages were half as likely to be made to a borrower with a FICO score below 620 or have an LTV above 90 (see Table 5, which scales the underwriting criteria for each category of loans by the value for the overall book; the 0.46 for Alt-A loans with FICO<620 means that the percentage of Alt-A loans with low FICO scores was equal to 46% of the percentage of all loans with low FICO scores). The average FICO scores and LTVs on Alt-A loans were roughly the same as the overall credit book.

(INSERT TABLE 5)

[4] A missing piece of the puzzle so far is the rise of "silent second" loans, which are second mortgages not recorded at time of origination of the first mortgages and not recorded in the pool data. There is some reason to believe (see Ashcraft and Scheuerman (2009)) that these mortgages increased very rapidly around 2004.

The additional risky mortgages are those with nontraditional amortization schedules: interest only and negative amortization loans (option adjustable rate mortgages are also included in the "NegAm" category). First, one should avoid double-counting these loans. According to Fannie Mae data, 45% of negative amortizing loans were Alt-A, as were 42% of interest-only loans. In total, $161 billion of interest only loans were classified as Alt-A (the combined figure could not be reported for negative amortization loans because Freddie Mac does not provide this breakdown).

As with Alt-A, loans with nontraditional amortization features were more conservatively underwritten. Negative amortizing loans were one-ninth as likely to have LTVs greater than 90 as the overall credit book; interest-only loans were 25% less likely to have LTVs above 90. While the percentage of negative amortizing loans with low FICO scores was somewhat higher – 8.5% of these loans versus 4.47% of all loans – interest only loans were half as likely to be made to borrowers with low FICO scores. Given that the risk posed by nontraditional amortization schedules is higher residual mortgage balances, it is not surprising that the underwriting adjustment focuses on LTV rather than FICO scores (at least as it concerns negative amortization loans) because the default sensitivity to FICO score should be no different than for other mortgages.

(INSERT TABLES 6 AND 7)

Breaking down "high risk" mortgages into specific categories allows one to compare informal *ex ante* estimates of various characteristics' marginal contribution to default likelihood to realized default rates (as measured by serious delinquencies and loss rates). As seen in Table 6, the delinquency rates on the various categories of mortgages differ greatly, but not necessarily in ways that are in line with expectations. Beyond the classic "subprime" mortgages with low FICO scores and high LTVs, the mortgages with the highest delinquency rates are those with nontraditional amortization features. While no breakdown is available, one could reasonably surmise that the large share of such mortgages labeled Alt-A also contributes substantially to that category's elevated default rate as well.

Table 7 provides delinquency rate by four states – California, Florida, Arizona, and Nevada. The divergence in delinquencies by state is nearly as great and adds a different perspective to the discussion. Each of these states had house price boom and busts: cumulative price increases ranged between 93% and 125% in these states compared to a cumulative 47% increase in national house prices during 2001-2005 (FHFA purchase index, 2010). In the 2006-2009 period,

house prices in these states fell by between 33% and 49%, well in excess of the 7.7% cumulative national decline (see Table 10).

(INSERT TABLE 8)

Table 8 scales average delinquency rates in the various categories as a multiple of the overall default rate on GSE mortgages. For example, the average default rate on high LTV mortgages (roughly 10%) is 2.22-times the overall default rate on GSE mortgages (just under 4.5%). The mortgages with the highest default rates are interest only loans, which are more than four times as likely to be seriously delinquent as the overall book. Next are negative amortization loans, followed by loans made to low-FICO borrowers, Alt-A mortgages, and all mortgages in the state of Nevada. Table 9 scales credit losses during 2008, 2009, and 2010 as a multiple of total loans in that category. For example, since interest only loans accounted for only 8% of Fannie Mae's total book of business, but 34% of its 2008 credit losses, the 2008 multiple for this category was 4.25. Measured as the ratio between the share of total credit losses and the share of total mortgages, Nevada loans are actually the riskiest category of loans (see Table 9).[5]

(INSERT TABLES 9 and 10)

What made loans in Nevada risky? Twenty-two percent of agency loans in Nevada were classified as Alt-A, twice the national rate. As of June 2010, 17.5% of Fannie Mae's Nevada loans were interest only, roughly three times the national rate of 6.1%. An additional 1.6% of Fannie's Nevada loans had negative amortization features, which was four times greater than the national average of 0.4% (see Table 11). What Nevada did not have was a high concentration of subprime loans: the concentration of loans with borrower FICO scores of under 620 were 30% less than the national average and the percentage of loans with initial loan-to-value ratios of 90 or higher was nearly 10% less than the national average, 9.7% compared to 10.4% for the national credit book.

The problem was the dramatic downturn in prices. During 2006-2009, house prices in Nevada fell by 49% on a cumulative basis. By June 2010, two-thirds of Fannie Mae loans in Nevada were thought to be underwater. Half had current or "mark-to market" LTVs of greater than 125% (8 times the national average) and the weighted average mark-to-market LTV stood at 129%. Agency loans in Nevada were 2.85 times as likely to be in nonaccrual status as the

[5] This excludes loans with "risk-layering," i.e. loans with both high LTV and low FICO scores. All loans with either characteristic are included so as to identify the marginal contribution of high LTV and FICO independent of the other.

national average, with 2010 credit losses from Nevada loans five times greater than their share of the overall credit book.

(INSERT TABLE 11)

The experience of Nevada points to other trends in the data. Only 1% of negative amortization loans and 7% of interest only loans had original LTVs in excess of 90, yet 80% of negative amortization loans and 49% of interest only loans were concentrated in the four states – California, Nevada, Florida, and Arizona – that experienced cumulative price declines that were between 4.35 and 6.41 times as severe as the national decline in house prices (see Tables 10 and 11).

Even more remarkable is that by June 2010, the categories of mortgages with the lowest share of high LTV loans – negative amortization (less than 1% at origination), Alt-A (4.8%), and interest only (7%) – had the highest share of underwater mortgages (compare the second and last lines on Table 5). While the mark-to-market (MTM) credit book-wide LTV ratio increased by between 2 and 3 percentage points, the average LTV on interest only and negative amortization loans have increased by 30 percentage points since origination. The mark-to-market average LTV on Alt-A loans is 20 percentage points higher than the average LTV at origination. Even though interest only loans were 25% less likely to have an LTV in excess of 90 as all mortgages, by 2010 they were more than 4 times as likely to be underwater as the rest of the book of business.

(INSERT CHART 3)

Would Alt-A, interest-only, and negative amortization loans really appear to be so high-risk had the average mark to market LTVs on these loans *not* increased by between 20 and 30 percentage points? Absent loan level data, which are not available, it is very difficult to estimate what the performance of these loans would have been had the states with high concentrations of these loans experienced price declines closer to the national average. That is especially true because these mortgages may have been made in response to declines in affordability and would not have been made in the absence of dramatic price increases. The correlation between the number of Alt-A mortgages as a percentage of total housing units and cumulative price increases from 2001-2005 is 76% (Federal Reserve Bank of NY, 2010). The correlation between the percentage of Alt-A loans as a percentage of all loans and cumulative price increases in California, Arizona, Florida, and Nevada, and Michigan is 87%. It is not clear in what direction causality runs in this relationship.

One could as easily argue that the availability of nontraditional mortgage products inflated housing prices in these states and the greater concentration of such mortgages was a cause of, rather than a symptom, of the bubble. Yet, even if one accepts that these products inflated housing prices, the GSEs did not begin to purchase these mortgages in large quantities until the second half of 2005 – just as house prices in each of these states was reaching its peak. Particularly notable is that nearly 90% of all interest-only loans were acquired between 2005 and 2007 (see Table 4). The most that could be said about the GSEs' 2006 and 2007 Alt-A mortgage purchases is that they helped temporarily to stabilize house prices in these states at unsustainable levels. They were not a likely cause of the bubble.

(INSERT CHART 4)

(INSERT TABLE 12)

What we have so far is very little reason to attribute GSE losses to housing policy and very little reason to attribute growth in the PLS market – especially the subprime part of it – or house prices to the GSEs. They did take on considerable risk beginning in 2005 in nontraditional markets, especially Alt-A loans and in markets that were about to crash. But the devil didn't make them do it; expanding into these markets was about business decisions to get back lost market share.

We would like to be able to break down the GSEs' portfolio so as to separate losses by those caused by economic conditions, especially property value changes, from those caused by ramping up risk by taking on riskier products. This would require performance by location, risk characteristics and product. We do not have publicly available to do that, but we do have data that go part of the way.

VII. FHFA Data and Marginal Impact of Mortgage Characteristics

The Federal Housing Finance Administration (FHFA) provides data on the percentage of mortgage loans that had experienced a 90-day delinquency at some point since origination. Loans are grouped into vintages from 2001-2008 with 90-day delinquencies, which we refer to as "defaults" from this point forward, measured through the end of 2009. In total, the panel consists of 3,072 loan categories that account for $10.5 trillion of mortgages purchased by the GSEs and PLS issuers over this period. The mortgages are segmented by origination channel, payment type (adjustable or fixed rate), and then sorted into eight FICO score and twelve loan-to-value (LTV) categories. Table 14 provides aggregated market share statistics and default rates. Note that the data are not capable of shedding direct light on losses, such as those in the Conservator's Report. They can, however, shed light on mortgage performance by origination year.

(INSERT TABLE 14)

We want to use these data to go as far as we can in explaining GSEs' loan performance. We can go a bit of the way by comparing vintages and reweighting them to estimate differences due to high overall default rates vs. differences due to observable underwriting changes. Table 17 Panel A compares the 2007 GSE loan book to that of 2003.

(INSERT TABLE 17)

There is no question that the 2007 vintage of loans is riskier: the share of high LTV and risk-layered loans nearly tripled, while the low FICO score loans grew by 35% relative to 2003. But how much would one anticipate this portfolio shift would increase cumulative default rates?

Panel B of Table 17 looks at the 2007 portfolio default rates at 2003 default rates and *vice versa*. Far more consequential than the change in portfolio composition was the intra-category changes in default rates. Had the 2007 vintage loans defaulted at the same rate as the same loans in 2003, the total 2007 default rate would have been just 3.79%, or about one-fourth of the actual default rate. Similarly, had 2003 loans defaulted at the rate of the same loans in 2007, the cumulative 2003 default rate would have been 10.74%, or 4.25-times the actual.

The most striking between the two vintages is the difference in default rates for ARMs. In general, one would anticipate that ARMs would default at a higher rate than FRMs because of the interest rate risk assumed by the borrower and because ARMs are frequently used to qualify marginal buyers who could not qualify for the same mortgage amount with a FRM. However, due to the low interest rate environment, ARMs originated in 2001-2003 actually outperformed FRMs. In 2003, GSE ARMs defaulted at the same rate as FRMs. In 2007, ARMs defaulted at twice the rate of FRMs, despite the fact that the 2007 ARMs were more conservatively underwritten with respect to FICO and LTV. In 2003, 73% of ARMs were prime, compared to 77% of FRMs.[6] In 2007, 72% of ARMs were still prime mortgages compared to only 59.5% of FRMs. Yet, the 2007 ARMs relative underperformance to 2003 was greater than for the FRMs. As with the data from the GSEs' financial reports, this suggests that 2006 and 2007 credit performance was more tied to payment features and changes in economic conditions than to traditional indicia of risk like credit score and downpayment.

[6] "Prime" here is used to describe mortgages with LTVs less than 90 and FICO scores greater than 660.

This tells us that losses had a lot to do with some combination of changes in economic conditions (probably house price changes) and in unobserved underwriting changes, such as the shift to Alt-A loans. We can use the FHFA data to model some of the difference. We do not have separate data on defaults by loan product, but we do know that the suspicious products associated with default were originated especially in 2006 and 2007. We can observe aggregate house price changes. We use that information and the FICO and LTV information to develop models of default, using fixed effects for origination in 2006 and 2007 as proxies for product changes.[7]

Measuring relative default intensity across vintage years can be challenging given the nature of the FHFA defaults data, which only record cumulative defaults through 2009 and not in the intervening years. Hence, our data have the same exposure year (2009) but differing observation periods of from one to nine years. We control for time by introducing a hazard rate approximation that uses time elapsed since origination to approximate a constant hazard rate that is directly comparable across vintage years. Assuming a constant decay, or hazard, rate, the cumulative default rate is represented as:

$$d = 1 - e^{-ht} \tag{1}$$

where d is the probability of defaulting at least once through 2009 as provided by FHFA, h is the average decay rate or hazard rate, and t represents the number of years elapsed since origination. For example, if a loan were originated in 2004, $t = 5 = 2009 - 2004$. The annualized hazard rate could be approximated as

$$h = \frac{-\ln(1-d)}{t} \tag{2}$$

The log of the hazard rate for mortgage loan category i could be used in (3) to estimate OLS parameters for each mortgage characteristic's proportional contribution to default intensity.

$$ln(h_i) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n \tag{3}$$

[7] We looked at fixed effects for other years. By and large there is little difference for fixed effects for origination years before 2006. As is seen below there is a significant effect for 2008 origination, but we are not sure abut that year because we only observe one year of default experience.

Since $e^{\alpha+\beta_1 X_1+\beta_2 X_2+\cdots\beta_n X_n} = e^{\alpha} e^{\beta_1 X_1+\beta_2 X_2+\cdots\beta_n X_n}$, (3) is equivalent to (4), where h_0 provides the "baseline" hazard rate and the parameters measure the exponentiated marginal effect of the explanatory variables on the baseline hazard rate.

$$h_i = h_0 e^{\beta_1 X_1+\beta_2 X_2+\cdots\beta_n X_n} \qquad (4)$$

In addition to the aforementioned mortgage categories, the explanatory variables used in the analysis are the cumulative percentage change in the FHFA House Price Index from time of origination to year-end 2009 (the percentage change between the end of 2009 index value and the average index value of the origination year), the percentage of Case-Shiller housing markets that had experienced greater than a 10% decline in house prices from the origination year to the end of 2009, and two indicator variables for 2006 and 2007 vintage mortgages. The market percentage experiencing 10% price declines is a proxy variable for underwater mortgages. In each case, the "baseline" mortgage category is fixed-rate mortgage loans funded by private label securities (PLS) with LTV less than 80, FICO scores greater than 660, and originated in years other than 2006 and 2007. Mortgage categories with cumulative default rates of 1 or 0 are discarded, as are categories for which no data are available.

(INSERT TABLE 15)

Panel B of Table 15 provides the results of the model run on three separate sets of data: (1) the entire data set of 3,092 loan categories, (2) only loans acquired by the GSEs; and (3) only loans acquired by PLS issuers. The baseline hazard rate in the full sample is 0.08%. The parameter estimated for the GSE dummy variable (not shown in the table) is (negative) -0.62081, which means that mortgages acquired by the GSEs over the period had a 46% lower hazard rate than PLS mortgages after controlling for the other factors. This equates to a 0.04% hazard rate for GSE mortgages, which is the same as the baseline hazard estimated in the GSE-only specification. All variables are statistically significant at the 1% level in the full sample with the exception of Index, which is collinear in this specification with the UW variable. Its inclusion does not affect the other parameter estimates. In the GSE sample, the 2006 vintage year dummy has a very modest impact and is not significant.

The fourth column in Panel B of Table 15 measures the estimated default sensitivity of each mortgage category in the GSE model as a multiple of the same default sensitivity as measured in the PLS specification. The risk category has a greater impact (measured in logs) on the hazard

rate for all categories with the exception of 2006 and 2007, Index, and the three LTV categories between 70 and 80.[8]

Although the parameters all have the expected signs, there is a curiosity in the data: the relationship between default intensity and LTV is not monotonic in the PLS sample. There are two "dips" in the relationship: loans with LTVs between 80 and 85 default at a lower rate than loans with LTVs exactly at 80. The same is true of mortgages in the 90-95 LTV range relative to loans right at 90 LTV (the 90 LTV effect also manifests itself in the GSE specification). This is suggestive of moral hazard, as the 80 and 90 LTV levels are often significant thresholds for the purposes or private mortgage insurance and risk-based pricing. Mortgages with LTV at these critical levels tend to underperform mortgages with marginally less subordination.

(INSERT TABLE 16)

Because the level of the Index is insignificant, we ran an additional regression using only the percentage of housing markets that experienced 40% declines between the origination year and the end of 2009 (labeled "SUW" for "severely underwater.") The parameter estimates from this specification are compared to those of the original model in Panel A of Table 16. All of the parameter estimates stay within 4% of those estimated in the original regression except those for the dummy variables for GSE, 2006, and 2007. The impact of a GSE purchase is very slightly attenuated, dropping the hazard by 39% instead of 46% (a 19% decline in sensitivity). Conversely, the impact of the 2006 and 2007 fixed effects becomes greater in the new specification: loans originated in 2006 are associated with a 57% higher hazard rate after controlling for the percentage of housing markets with 40% declines; even more remarkably, the marginal impact of the dummy for 2007 rises exponentially, increasing the baseline hazard by 5.45-times compared to 2.5-times in the original specification.

Panel B of Table 16 compares the parameters estimated in the SUW specification with the Index and UW model for GSE loans only. The impact is generally the same, with the parameters for virtually all loan categories staying constant and modest increases in default sensitivity for high LTV loans and ARMS. However, the impact on the 2006 and 2007 dummy variables is striking: the coefficient for 2007 more than doubles in size while the 2006 coefficient rises ten-fold and becomes statistically significant at the 1% level. *Under this specification, the effect of being originated in 2007 on the hazard rate is equal to the impact of a reduction in FICO score from*

[8] It is important to recognize that the actual contribution to the GSE hazard rate is lower across all risk categories because none of the GSE/PLS sensitivity multiples exceed 2.41, which is the ratio of the baseline PLS hazard rate to the GSE baseline hazard.

740 to 640. This finding is in line with the full sample, where the coefficient on the 2007 dummy variable exceeds that for FICO2 (a FICO score greater than 620 but less than 640).

The key finding in Table 16 is that the parameters for LTV and FICO categories remain constant however one accounts for the impact of house price changes. The impact is almost entirely absorbed by the 2006 and 2007 variables, which means that mortgages in these vintages perform even worse than would be expected after controlling for the substantial number of markets with greater than 40% declines in prices since origination. The option-theoretic literature (Deng, Quigley, and Van Order, 2000) suggest drops in housing prices will have nonlinear effect on default rates, with exceptionally large declines resulting in default rates several times greater than would be predicted by linear extrapolations. This is intuitive, as the state of being 40%-50% underwater on one's mortgage seems ontologically different from merely being merely 10%-15% underwater. But when accounting for this nonlinearity by using SUW instead of UW and vintage, the fixed effects of 2006 and 2007 vintage become more pronounced.

The statistically significant dummy variables for 2006 and 2007 suggest that some of the decline in underwriting standards was unobservable from our data, likely a reflection of the growth of Alt-A and low documentation loans. But neither the observable portfolio shifts nor the decline in house prices are able to explain the growth in hazard rates.

We estimated a separate version of the baseline specification of Table 15 with data limited to 2001-2005 vintage GSE mortgages without fixed effects for origination year. We found that the dummy for ARMs is associated with a 4% *decline* in hazard rates. While a small effect economically, the parameter is significant at the 10% confidence interval. While this is likely explained by the low interest rate environment that prevailed until 2004, payment type seemed to have less of influence on default rates through the interest rate cycle. The original hazard model finds ARMs increase default intensity by 22%, after controlling for other factors. To put this in context, this is less than half of the expected impact of a decline in FICO score from 750 to 730.

Table 18 compares the actual hazard rate for all GSE mortgages, GSE FRMs, and GSE ARMs to the hazard rate predicted in the baseline model when excluding the effect of origination year. The hazard rate for each of the 192 mortgage categories is estimated and then aggregated by multiplying the hazard rates by a vector of dollar-volume weights for each mortgage category for each year. This process allows the forecast hazard rate to be decomposed by mortgage portfolio and price impact.

(INSERT TABLE 18)

The "baseline" row in Table 18 measures the estimated hazard rate for ARMs and FRMs of each vintage year with the change in average house prices and the percentage of markets with a 10% decline fixed at the average for the 8 year window. The "price effect" row measures the incremental impact of that vintage year's housing price path on the hazard rate. For example, house prices are shown to reduce hazard rates until 2004 when price changes begin to contribute to greater default intensity. The "unexplained" row is just that: the difference between the actual hazard for that year and the hazard estimated by observed changes in mortgage portfolio composition and house prices. After correctly forecasting hazards from 2001-2003, the model overestimates hazards for fixed rate mortgages in 2004 and 2005 and then badly underestimates hazards on all mortgages in 2006 and 2007, with ARM default intensity increasing substantially.

If one focuses only on observable mortgage characteristics (LTV and FICO score), there is virtually no increase in risk-taking over the eight years. The baseline hazard for all loans averages 1.2% over the period with a maximum of 1.5% in 2007 and a minimum of 1% in 2008. Again, mortgages in 2007 look marginally more risky, on average, than mortgages originated in other years based on LTV and FICO score. But the increase in risk is a small fraction of the increase in default intensity. This remains the case even after accounting for the impact of price changes. In total, the model underestimates the 2007 hazard by a whopping 12.2%, even as the same model overestimates the default intensity of 2005 vintage year FRMs.

Charts 5, 6, and 7 provide a graphical depiction of this phenomenon. The grouping of bars on the left of each graph consists of FRMs sorted from left-to-right by increasing risk profile (FICO, LTV, etc.) The grouping of bars on the right is ARMs in the same order. The red bars measure the mortgage portfolio mix's contribution to the cumulative default rate, the blue bars measure the impact of price changes, and the green bars represent the unexplained portion for each category. The green bars tend to be negative in 2005, suggesting the model overestimates default rates (negative unexplained variation). The green bars are hardly apparent in the 2006 FRMs, with many categories of loans outperforming the forecast as in 2005. Conversely, the green bars dominate the 2006 and 2007 ARMs graphics across the entire risk spectrum, with 2007 FRMs also performing significantly worse than anticipated.

(INSERT CHARTS 5, 6, and 7)

Clearly there was something different about the 2007 vintage (and 2006) that made defaults worse even after controlling for observed underwriting and house price changes. We suspect that it was about the switch to Alt-A type mortgages, but out data do not allow a precise decomposition.

Piecing together the FHFA loan category data with what we know from the credit supplements and SEC filings allows for well-informed speculation about the nature of the spike in defaults. Interest-only (IO) loans accounted for 15% and 20% of total GSE purchases in 2006 and 2007, respectively, and 86% of IO loans on the balance sheet in 2008 were originated in 2005-2007. This helps to explain the rise in ARM defaults because nearly 90% of IO mortgages were ARMs (OFHEO, 2007), as were 100% of option ARMs (about 3% of 2006 purchase volume). Given that these mortgages were concentrated in areas that experienced the greatest housing price declines, the unexplained variation in ARM default rates is likely a manifestation of the meltdown in IO mortgages discussed earlier. This also helps explain why unexplained variation in 2007 is greater than for 2006 given that more IO mortgages were purchased that year.

Table 19 provides a final specification that attempts to account for what we know about changes in product features. The model includes an interaction term for ARM and 2007 mortgages, "interact07" and an indicator variable for 2008 mortgages, which performed very poorly due to the economic crisis despite being conservatively underwritten and originated after most of the drop in prices had occurred. All variables are significant at the 1% level. Chart 8 provides a graphic depiction of this model's residuals sorted by vintage year. The x-axis is labeled from one to 1500 because the first 192 mortgage categories are for 2001, the next 192 are for 2002, etc. While there is some evidence of a pattern across the residuals in some of the years, there is no clear upward or downward trend through time.

As was shown in Table 12, only about one-third of Alt-A loans are ARMs, so the 2006 and 2007 vintage year dummy variables proxy for Alt-A and other underwriting changes unobservable in the FHFA data. The interaction term for 2007 provides an estimate of the marginal impact of IO loans, which is hugely economically significant when controlling for ARMs and 2007 mortgages. When summing parameters, the hazard rate on a 2007 ARM is 7.54-times greater than that of an FRM with an identical FICO score and LTV originated in a different year when holding price effects constant. This suggests that nearly 50% of the increase in default intensity of 2007 mortgages is caused by factors beyond prices and traditional mortgage risk characteristics.

VI. Conclusions

Clearly the verdict is still out and will be until we get more data, especially disaggregated data, and until we see the final results for the 2006-2008 vintages of mortgages and PLS. But we have some suggestive information:

Things we know:

- Housing policy via Subprime PLS was not a major factor in Fannie/Freddie losses. Losses mainly came from business lines, primarily Alt-A and interest only mortgages, that had little to do with low income housing goals.
- Their portfolios were not an important source of their loss, which came entirely from credit risk rather than interest rate risk, and which was primarily funded by their "traditional" securitization business.
- Fannie and Freddie did not cause the subprime boom and bust. They did have a large role in buying senior pieces of structured deals, but these were the easy AAA parts that lots of investors wanted. They were not involved in the crucial CDO market or other vehicles for selling the important junior pieces of the deals.
- Loans acquired by Fannie and Freddie outperformed PLS-funded loans across categories and vintage years by ratios of over two to one.

Things we think we think we know:

- Fannie and Freddie were most likely not the victims of housing policy in dimensions other than subprime PLS (like high LTV and FICO) because changes in those explain little of their default changes.
- A large share of their losses on Alt-A and nontraditional loans was associated with property value declines; these loans began with smaller than average shares of high LTV loans but wound up with much higher shares of underwater mortgages, presumably because of their locations and origination years.
- Fannie and Freddie were not a major factor in the price bubble.

Things we don't know:

- We do not know how much of losses were from price declines and how much from loan quality (especially Alt-A and interest-only mortgages). We have reason to believe that both were important, and that quality was especially important in explaining the 2006 and 2007 vintages. 2007 was an especially unpalatable vintage.
- We don't know what overall losses will finally be.

The data do not provide empirical support for the notion that Fannie and Freddie were building up to a collapse over an extended period of time. Collapse happened quite quickly-almost entirely via loans originated after 2005. The dummy variables for these vintage years are

significant irrespective of house price proxy, which suggests unobserved (from FHFA data) changes in mortgage quality interacted with the price declines to result in seven-fold increases in default rates.

The main problems, economy-wide, were a price bubble, which took off while the GSEs' market share (including the subprime securities they acquired in 2003 and 2004) was falling, and a panic in the shadow banking system, not in agency securities (firming up the implicit guarantee took care of that). There were two major problems for the GSEs: they did not have the capital to survive the decline in property values beginning around 2006, and they ramped up their risk-taking when their market share fell and the franchise was in danger. These are both serious problems, but they are not unique to the GSE structure.

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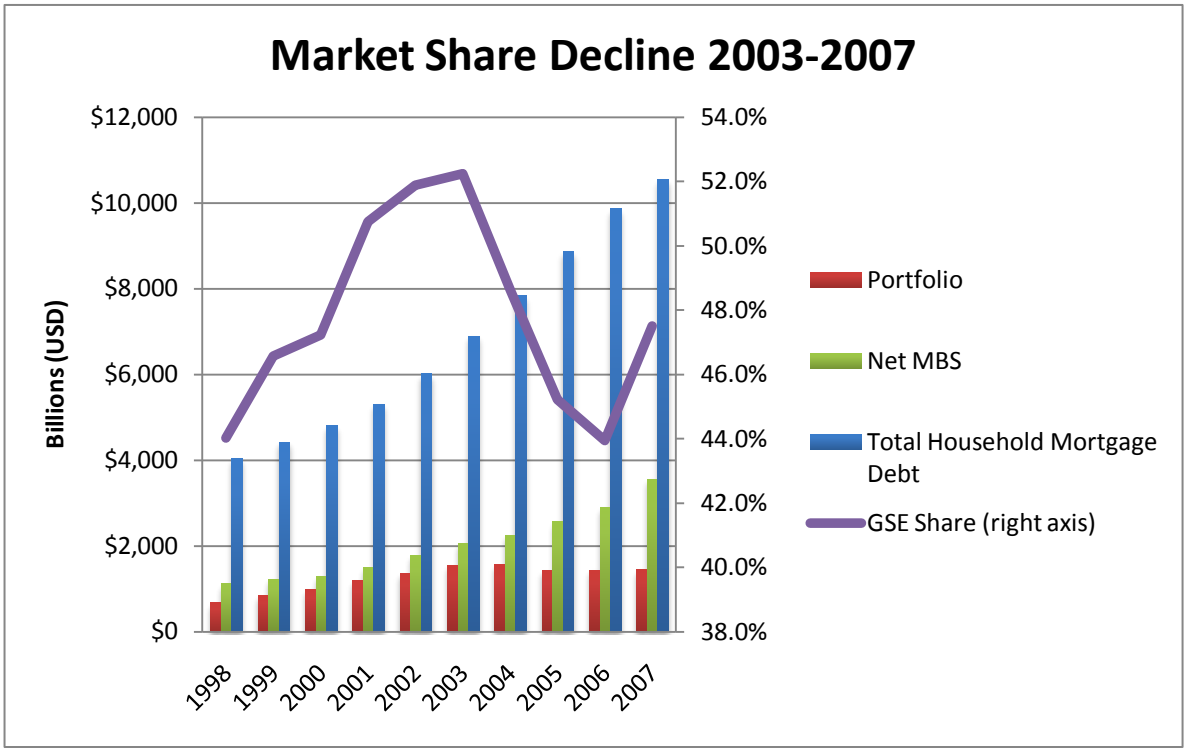
Chart 1



Source: Federal Reserve, Enterprise Monthly Funding Summaries

Chart 2

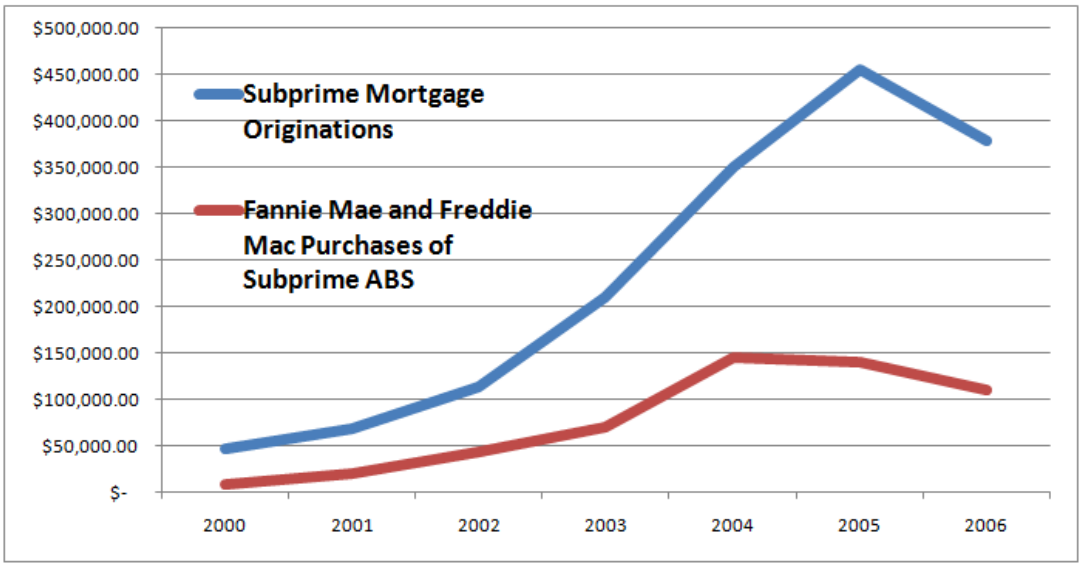
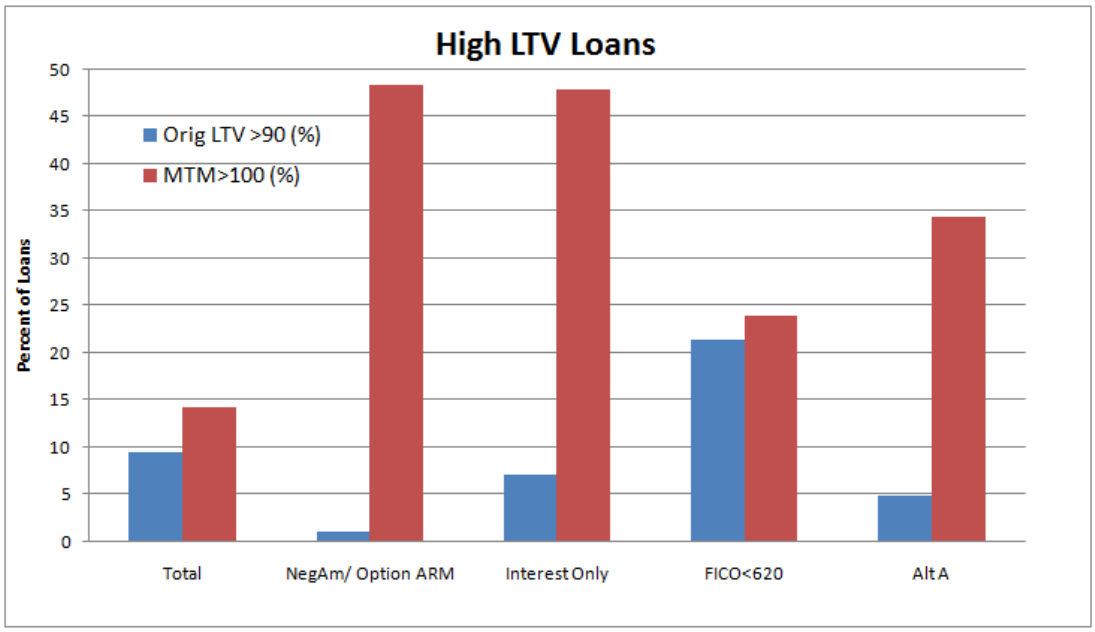


Chart 3



Source: Credit Supplements 2010

Chart 4

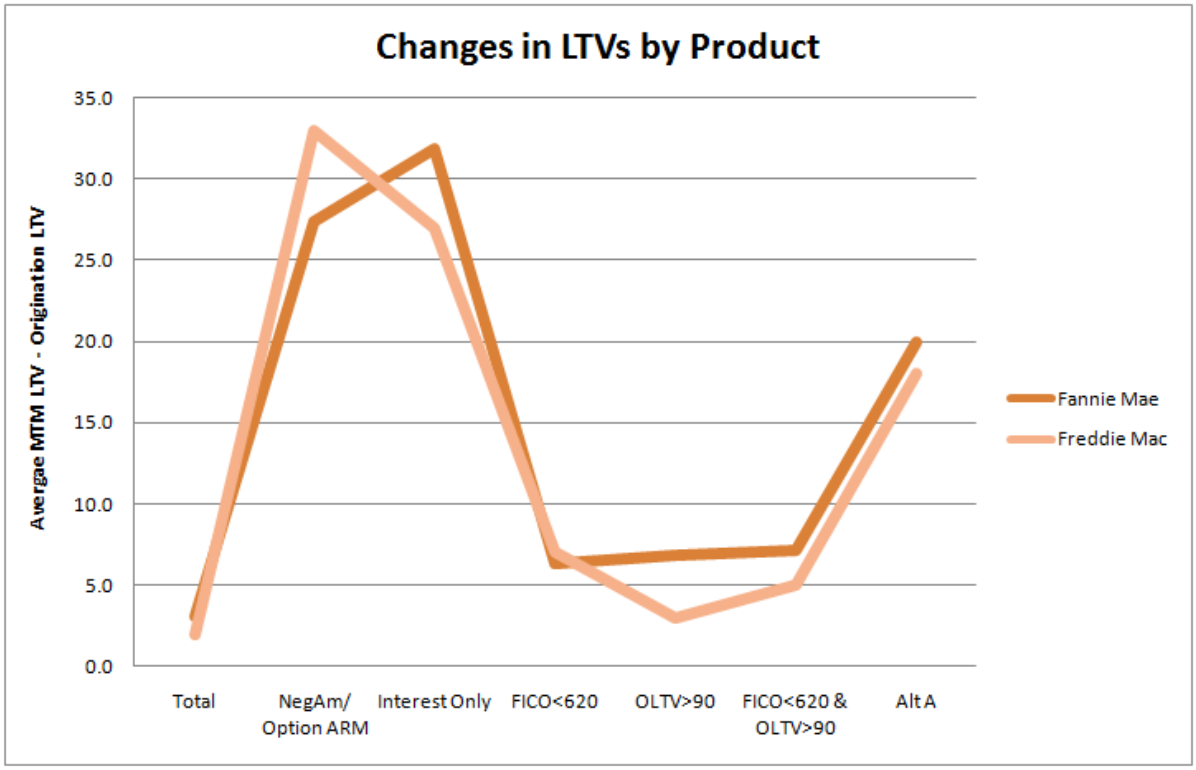

Changes in LTVs by Product
Avergae MTM LTV - Origination LTV
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Total
NegAm/ Option ARM
Interest Only
FICO<620
OLTV>90
FICO<620 & OLTV>90
Alt A
Fannie Mae
Freddie Mac

Chart 5: 2005 Actual Defaults Compared to Predicted

(Left grouping is FRM sorted from low to high risk; the right is ARMs sorted in the same manner)

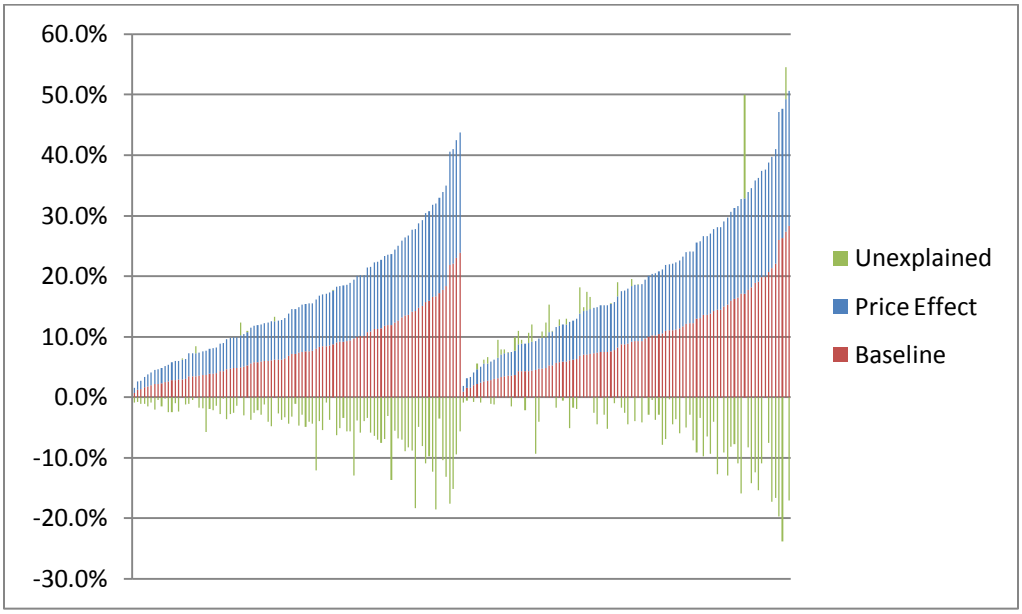


Chart 6: 2006 Actual Defaults Compared to Predicted

(Left grouping is FRM sorted from low to high risk; the right is ARMs sorted in the same manner)

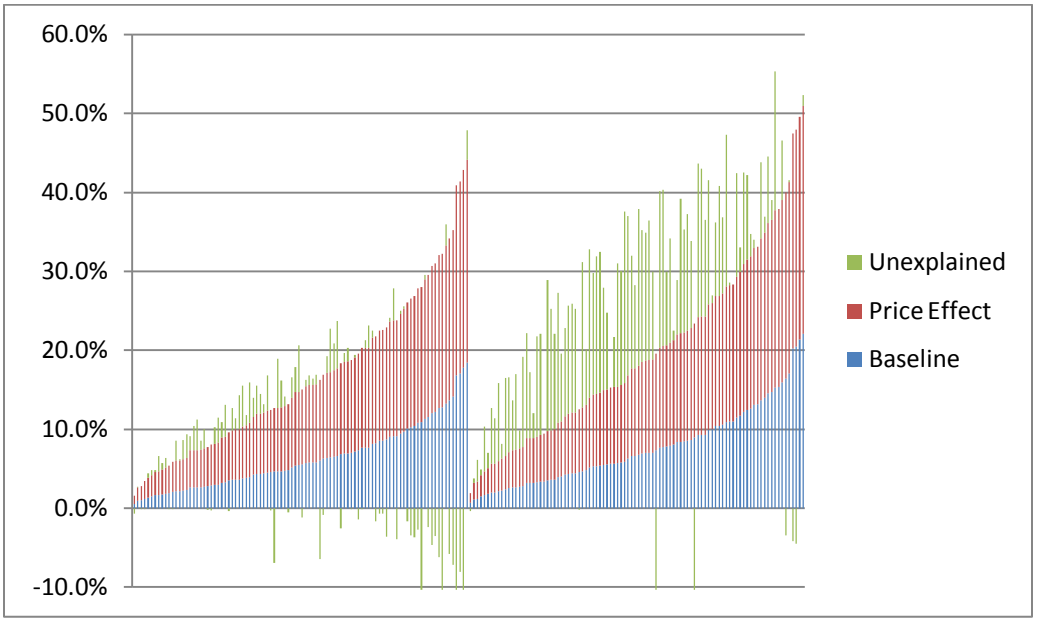


Chart 7: 2007 Actual Defaults Compared to Predicted (Left grouping is FRM sorted from low to high risk; the right is ARMs sorted in the same manner)

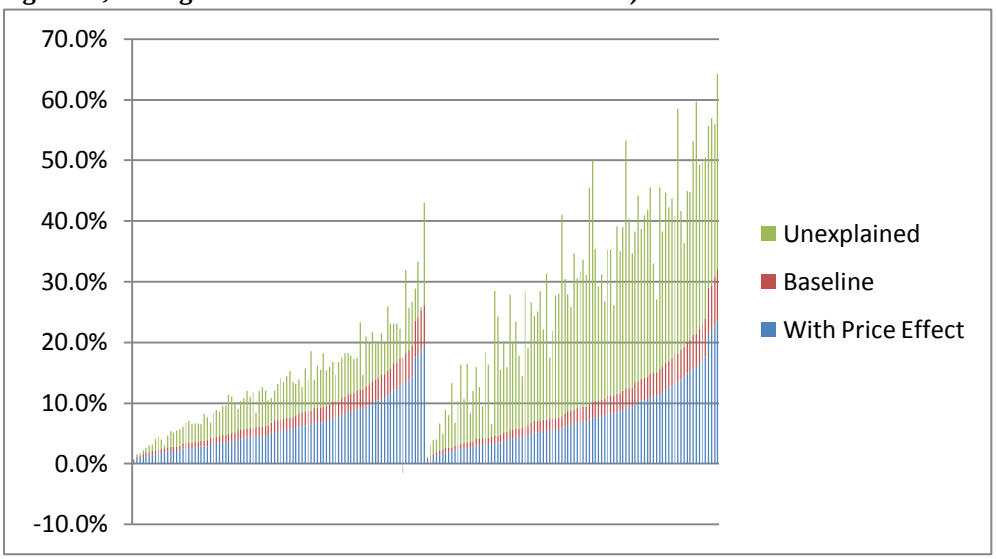


Chart 8

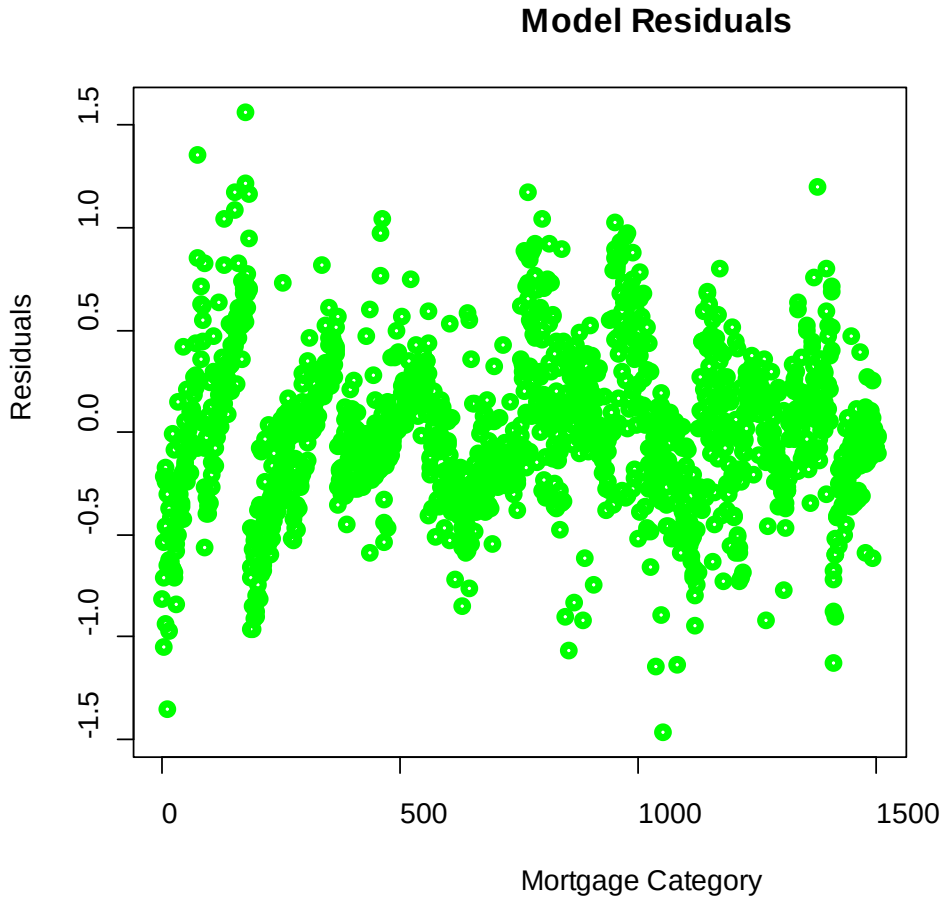


Table 1
(in billions $)

	Fannie Mae		Freddie Mac		Total Book of Business	Total Household Mortgage Debt	GSE Share (outstanding)	GSE Share (new business)
	Portfolio	Net MBS	Portfolio	Net MBS				
1998	415.2	637.1	255.0	478.4	1,786	4,041	44.0%	NA
1999	522.8	679.2	324.4	537.9	2,064	4,416	46.6%	NA
2000	607.4	706.7	385.7	576.1	2,276	4,798	47.2%	NA
2001	705.2	858.9	491.7	646.4	2,702	5,305	50.7%	67%
2002	790.8	1,029.5	568.2	742.9	3,131	6,010	51.9%	68%
2003	898.4	1,300.2	645.5	752.2	3,596	6,894	52.3%	70%
2004	904.6	1,402.8	653.6	852.0	3,813	7,835	48.6%	47%
2005	727.2	1,598.1	710.0	974.2	4,009	8,874	45.2%	41%
2006	724.4	1,780.1	703.6	1,122.8	4,331	9,865	44.0%	40%
2007	724.0	2,165.6	720.8	1,381.9	4,992	10,539	47.5%	58%

Source: Federal Reserve, Enterprise Monthly Funding Summaries

Table 2

PLS Market Summary

	Total Market		Fannie Mae		Freddie Mac		Combined GSE %	
	Subprime	Alt-A	Subprime	Alt-A	Subprime	Alt-A	Subprime	Alt-A
2007	$ 72,204.75	$ 164,883.71	$ 15,971	$ 5,288	$ 43,667	$ 10,008	82.6%	9.3%
2006	$ 377,522.86	$ 431,092.31	$ 35,606	$ 11,973	$ 74,761	$ 30,546	29.2%	9.9%
2005	$ 455,714.38	$ 421,250.99	$ 24,469	$ 16,109	$ 114,636	$ 26,994	30.5%	10.2%
2004	$ 349,602.10	$ 243,331.10	$ 67,003	$ 21,999	$ 77,129	$ 18,162	41.2%	16.5%
2003	$ 210,465.52	$ 99,610.86	$ 25,769	$ 8,104	$ 44,051	$ 10,373	33.2%	18.5%
2002	$ 113,986.83	$ 57,914.40	$ 5,144	$ 1,756	$ 37,823	$ 8,906	37.7%	18.4%
2001	$ 67,509.82	$ 36,470.98	$ 5,087	$ 492	$ 15,586	$ 3,670	30.6%	11.4%
2000	$ 47,310.17	$ 17,164.53	$ 2,410	$ 1,185	$ 6,564	$ 1,546	19.0%	15.9%

Source: GAO Analysis of LoanPerformance data, FHFA, Enterprise Credit Supplements

Table 3

Percentage of Annual Mortgage Purchase Volume

	Fannie Mae		Freddie Mac	
	FICO<620	LTV>90	FICO<620	LTV>90
2001	5.0%	13.0%	4.0%	11.0%
2002	6.0%	8.0%	4.0%	7.0%
2003	5.0%	7.0%	3.0%	5.0%
2004	5.0%	9.0%	9.0%	6.0%
2005	5.0%	9.0%	4.0%	6.0%
2006	6.0%	10.0%	5.0%	6.0%
2007	6.0%	16.0%	6.0%	11.0%
2008	3.0%	10.0%	4.0%	9.0%

Source: Annual Reports, FHFA

Table 4

MTM stands for mark-to-market loan-to-value ratios (LTV) as of June 30, 2008 and 2010

Combined	Total	NegAm/ Option ARM	Interest Only	FICO<620	OLTV>90	FICO<620 & OLTV>90	Alt A
Total ($B)	$4,504	$32	$381	$203	$422	$44	$497
LTV at Origination	71.47	71.47	74.89	77.00	97.24	97.65	72.41
Orig LTV >90 (%)	9.42	0.99	7.02	21.31	100.00	100.00	4.83
MTM LTV (6/2008)	65.52	79.88	84.05	72.63	91.24	92.24	74.80
MTM LTV>100(%)	6.23	28.97	27.80	9.99	27.99	30.20	13.63
2005-2007 (%)	50.70	66.20	86.33	58.93	60.37	66.86	75.04
FICO (avg)	722.82	702.12	722.55	588.41	692.00	590.78	721.04
FICO< 620 (%)	4.47	8.50	1.99	100.00	10.30	100.00	2.05
UPB	$145,297	$158,233	$246,151	$129,395	$136,942	$121,291	$173,183
MTM (avg; 2010)	73.8	101.2	104.7	83.3	102.4	103.9	91.8
MTM>100 (%) 2010	14.2	48.4	47.9	23.9	41.7	46.7	34.4

Source: Credit Supplements

Table 5

As a Multiple of the Overall Book

(the average of each category of mortgage is divided by the average for the entire credit book)

Combined	Total	NegAm/ Option ARM	Interest Only	FICO<620	OLTV>90	FICO<620 & OLTV>90	Alt A
Orig LTV	1.00	1.00	1.05	1.08	1.36	1.37	1.01
Orig LTV >90 (%)	1.00	0.11	0.75	2.26	10.61	10.61	0.51
MTM LTV (2008)	1.00	1.22	1.28	1.11	1.39	1.41	1.14
MTM LTV>100(%)	1.00	4.65	4.46	1.60	4.49	4.85	2.19
2005-2007 (%)	1.00	1.31	1.70	1.16	1.19	1.32	1.48
FICO (avg)	1.00	0.97	1.00	0.81	0.96	0.82	1.00
FICO< 620 (%)	1.00	1.90	0.45	22.35	2.30	22.35	0.46
UPB	1.00	1.09	1.69	0.89	0.94	0.83	1.19
MTM (avg; 2010)	1.00	1.37	1.42	1.13	1.39	1.41	1.24
MTM>100 (%) 2010	1.00	3.40	3.36	1.68	2.93	3.28	2.42

Source: Credit Supplements

Table 6

Percent Seriously Delinquent

	Total	NegAm/ Option ARM	IO	FICO<620	OLTV>90	FICO<620 & OLTV>90	Alt A
Fannie Mae	4.99	9.91	19.43	16.12	11.55	24.28	15.17
Freddie Mac	3.96	20.30	18.40	14.44	8.45	17.86	12.44

Source: Credit Supplements, 2010

Table 7

Percent Seriously Delinquent

	Total	CA	FL	AZ	NV
Fannie Mae	4.99	5.5	10.4	6.8	12.3
Freddie Mac	3.96	5.0	12.6	7.5	12.8

Source: Credit Supplements, 2010

Table 8

Scaled Delinquency Rates

Characteristic	Multiple
Interest Only	4.27
NegAm/ Option ARM	3.56
FICO<620	3.44
Alt A	3.09
NV	2.85
2007	2.78
FL	2.63
2006	2.50
OLTV>90	2.22
AZ	1.62
2005	1.44
CA	1.18
2008	0.96
2004 & Earlier	0.59

Source: Credit Supplements 2010

Table 9

Percentage of Fannie Mae Credit Losses as a Multiple of Percentage of Loans

	2008	2009	2010
Nevada	5.00	7.00	5.00
Interest Only	4.25	4.13	3.75
Arizona	2.67	3.67	3.33
Alt-A	4.18	3.64	3.27
Florida	1.57	2.29	2.71
2006	2.50	2.21	2.14
2007	1.40	1.80	1.85
California	1.56	1.50	1.44

Percentage of Freddie Mac Credit Losses as a Multiple of Percentage of Loans

	2008	2009	2010
Nevada	4.00	6.00	5.00
Interest Only	5.56	5.22	4.33
Alt-A	5.00	4.40	4.00
Arizona	3.00	3.67	3.67
Florida	1.43	2.14	2.71
2006	2.73	2.33	2.00
California	2.14	2.29	1.86
2007	1.32	1.89	1.79

Source: FHFA Conservator's Report

Table 10

Cumulative Price Changes

Period	California	Florida	Arizona	Nevada
2001-2005	125.0%	112.2%	93.3%	110.8%
2006-2009	-38.68%	-35.5%	-33.4%	-49.2%

Cumulative Price Changes as a Multiple of National Average

Period	California	Florida	Arizona	Nevada
2001-2005	2.63	2.36	1.96	2.33
2006-2009	5.04	4.63	4.35	6.41

Source: OFHEO and FHFA

Table 11

		CA	FL	AZ	NV	National
FRE	Delinquency	5.0	12.6	7.5	12.8	4.0
Combined	Alt-A (% of Loans)	16.0	16.0	14.6	22.0	11.0
FNM	Delinquency	5.5	10.4	6.8	12.3	5.0
	Original LTV (avg)	63.8	73.2	73.8	74.6	71.3
	Original LTV > 90	3.4	10.4	10.3	9.5	
	MTM LTV (avg)	75.3	101.5	100.4	129.1	74.4
	MTV LTV > 100 <125	10.5	18.5	19.3	16.3	8.5
	MTM LTV > 125	10.3	27.3	25.1	49.6	5.9
	Underwater	20.8	45.8	44.4	65.9	14.4
	2005-2007	45.4	61.5	64.1	62.7	32.7
	Interest Only (%)	9.7	10.2	12.5	17.5	6.1
	Interest Only ($B)	48.2	19.3	9.2	5.8	169.9
	% of all IO Loans	28.4	11.4	5.4	3.4	100.0
	NegAm (%)	1.4	1.0	0.5	1.6	0.4
	NegAm($B)	7.0	1.9	0.4	0.5	12.3
	% of All NegAM Loans	56.5	15.4	3.0	4.3	
	MTM LTV as % of orig	105.6	142.4	140.8	181.1	

Source: Credit Supplements

Table 12

Alt- A Summary

Combined	Total	2008	2007	2006	2005	2004 and earlier*
Total ($B)	$497	$20	$139	$142	$90	$106
% of Total	100	4	28	29	18	21
FICO (avg)	721	734	717	718	723	724
FICO<620 (%)	2	1	1	1	1	3
FICO<620 ($B)	$10	$0	$2	$2	$1	$3
% of Total	**100**	**1**	**21**	**21**	**13**	**33**
Orig LTV> 90(%)	5	3	8	4	3	4
Orig LTV> 90 ($B)	$24	$1	$10	$6	$2	$4
% of Total	**100**	**3**	**43**	**25**	**10**	**16**
ARM (%)	33	12	30	38	48	21
ARM ($B)	$166	$2	$41	$55	$43	$22
% of Total	**100**	**1**	**25**	**33**	**26**	**13**
Interest Only (%)	32	10	41	42	32	10
Interest Only ($B)	$161	$2	$57	$60	$29	$10
% of Total	**100**	**1**	**35**	**38**	**18**	**6**
California (%)	22	20	24	20	21	21
California ($B)	$108	$4	$33	$29	$19	$22
% of Total	**100**	**4**	**31**	**27**	**17**	**21**
Florida (%)	10	7	11	12	12	8
Florida ($B)	$52	$1	$15	$17	$11	$8
% of Total	**100**	**3**	**28**	**33**	**21**	**16**

* FNM does not break out 2004 purchases; FRE purchased $18 B Alt-A in 2004.

Source: Credit Supplements, 2010

Table 13

	Low- & Moderate-Income Base Goal		Special Affordable Base Goal		Underserved Base Goal	
	Actual*	Goal	Actual*	Goal	Actual*	Goal
Alt-A Originations						
1999	**48.83%**	42%	**24.17%**	14%	**37.41%**	24%
2000	40.61%	42%	**18.74%**	14%	**41.03%**	24%
2001	39.05%	50%	16.41%	20%	**40.66%**	31%
2002	42.77%	50%	18.13%	20%	**40.08%**	31%
2003	42.42%	50%	16.81%	20%	**37.34%**	31%
2004	44.13%	50%	18.56%	20%	**40.08%**	31%
2005	43.12%	52%	18.57%	22%	**45.36%**	37%
2006	40.43%	53%	18.09%	23%	**46.40%**	38%
2007	39.02%	55%	17.29%	25%	**50.29%**	38%
2008	42.37%	56%	18.52%	27%	**42.10%**	39%

Source: Wallison (2011)

Table 14: FHFA Data Summary

Cumulative Default Rates

	GSE			PLS		
	FRM	**ARM**	**Total**	**FRM**	**ARM**	**Total**
2001	2.5%	2.2%	2.5%	16.4%	22.5%	20.2%
2002	2.3%	1.8%	2.2%	11.6%	16.8%	15.0%
2003	2.5%	2.5%	2.5%	9.5%	13.3%	11.8%
2004	4.2%	4.8%	4.3%	12.4%	16.0%	15.1%
2005	6.8%	11.8%	7.8%	19.7%	31.8%	28.7%
2006	11.1%	23.4%	13.2%	32.5%	50.6%	45.1%
2007	13.3%	28.7%	14.9%	31.7%	49.5%	42.3%
2008	4.1%	5.2%	4.2%	10.2%	18.3%	14.5%

Annualized Hazard Rates

	GSE			PLS		
	FRM	**ARM**	**Total**	**FRM**	**ARM**	**Total**
2001	0.3%	0.3%	0.3%	2.2%	3.2%	2.8%
2002	0.3%	0.3%	0.3%	1.8%	2.6%	2.3%
2003	0.4%	0.4%	0.4%	1.7%	2.4%	2.1%
2004	0.9%	1.0%	0.9%	2.7%	3.5%	3.3%
2005	1.8%	3.1%	2.0%	5.5%	9.6%	8.4%
2006	3.9%	8.9%	4.7%	13.1%	23.5%	20.0%
2007	7.1%	16.9%	8.0%	19.1%	34.2%	27.5%
2008	4.2%	5.3%	4.3%	10.7%	20.2%	15.7%

Share of All Defaulted Loans

	GSE		PLS	
	FRM	**ARM**	**FRM**	**ARM**
2001	2.3%	0.1%	0.4%	0.9%
2002	2.6%	0.2%	0.5%	1.3%
2003	4.0%	0.4%	0.8%	1.9%
2004	2.9%	0.9%	1.3%	5.0%
2005	4.9%	1.9%	2.7%	12.7%
2006	7.9%	3.4%	4.1%	14.7%
2007	11.8%	2.9%	1.3%	3.0%
2008	3.0%	0.3%	0.0%	0.0%

Percentage of Loan Volume

	GSE			PLS		
	FRM	**ARM**	**Total**	**FRM**	**ARM**	**Total**
2001	89.9%	4.0%	93.9%	2.4%	3.8%	6.1%
2002	83.3%	8.3%	91.6%	2.9%	5.4%	8.4%
2003	79.7%	8.9%	88.6%	4.4%	7.0%	11.4%
2004	53.2%	14.2%	67.4%	8.0%	24.6%	32.6%
2005	50.4%	11.5%	62.0%	9.8%	28.2%	38.0%
2006	55.8%	11.3%	67.1%	10.0%	22.9%	32.9%
2007	81.4%	9.3%	90.7%	3.8%	5.5%	9.3%
2008	93.5%	6.5%	100.0%	0.0%	0.0%	0.0%

Table 15: Panel A: Summary of Variables

FICO1	Mortgages with a FICO score <620
FICO2	Mortgages with a FICO score 620<X<640
FICO3	Mortgages with a FICO score 640<X<660
FICO4	Mortgages with a FICO score 680<X<700
FICO5	Mortgages with a FICO score 700<X<720
FICO6	Mortgages with a FICO score 700<X<740
FICO7	Mortgages with a FICO score >740
LTV2	Mortgages with an LTV 60>X>70
LTV3	Mortgages with an LTV 70>X>75
LTV4	Mortgages with an LTV 75>X>80
LTV5	Mortgages with an LTV =80
LTV6	Mortgages with an LTV 80>X>85
LTV7	Mortgages with an LTV 85>X>90
LTV8	Mortgages with an LTV=90
LTV9	Mortgages with an LTV 90<X<95
LTV10	Mortgages with an LTV 95>X>97.5
LTV11	Mortgages with an LTV 97.5>X>105
LTV12	Mortgages with an LTV >105
X2006	Mortgages originated in 2006
X2007	Mortgages originated in 2007
Index	Cumulative percentage change in FHFA Price Index
SUW	Percentage of Metro Areas with >40% price declines
UW	Percentage of Metro Areas with >10% price declines
ARM	Adjustable Rate mortgages
GSE	Mortgages acquired by the GSEs

Table 15: Panel B

This panel presents the baseline hazard rate for the entire data set, GSE loans, and PLS loans. Each loan category's marginal contribution to default likelihood is measured as a multiple of the baseline hazard rate. The fourth column measures the default contribution of each category in the GSE specification to the contribution for the same in the PLS specification. Unless noted, all parameters significant at 1% level.

	Full Data Set	GSE Loans Only	PLS Loans Only	GSE Sensitivity as Multiple of PLS
Baseline Hazard	0.08%	0.04%	0.09%	
Baseline for GSE Loans	0.04%			
Risk Contribution (measured as a multiple of baseline)				
FICO (Baseline >740)				
0 - 619.9	6.93	9.21	5.03	1.83
620 - 639.9	4.82	6.38	3.51	1.82
640 - 659.9	4.07	5.20	3.06	1.70
660 - 679.9	3.37	4.08	2.71	1.50
680 - 699.9	2.70	3.28	2.18	1.50
700 - 719.9	2.20	2.56	1.87	1.37
720 - 739.9	1.68	1.91	1.47	1.30
LTV (Baseline <60)				
60 - 69.9	1.78	1.81	1.75	1.03
70 - 74.9	2.48	2.45	2.52	0.97
75 - 79.9	2.98	2.76	3.25	0.85
80	3.53	3.20	3.94	0.81
80.1 - 84.9	3.20	3.65	2.74	1.33
85 - 89.9	3.97	4.12	3.81	1.08
90	4.81	4.91	4.70	1.05
90.1 - 94.9	3.82	4.09	3.52	1.16
95 - 97.4	4.87	4.85	4.89	0.99
97.5 - 104.9	5.31	6.41	4.28	1.50
105 +	5.11	5.84	4.22	1.39
ARM	1.22	1.27	1.18	1.08
X2006*	1.37	1.04	1.93	0.54
X2007	2.51	2.08	3.21	0.65
Index (10% increase)**	0.98	0.85	1.12	0.75
UW (10% increase)	1.34	1.33	1.33	1.00

*- not significant in GSE specification

**- not significant in full data set

Table 16: Comparison of Models with Differing Proxies for Price Declines

Panel A: Full Data Set

("SUW" reflects the percentage of markets that experienced a cumulative price decline of greater than 40% from the origination year to the end of 2009)

Parameter	SUW	Original	% Change
(Intercept)	-6.417	-7.131	-10.0%
FICO1	1.891	1.935	-2.3%
FICO2	1.532	1.572	-2.5%
FICO3	1.364	1.403	-2.8%
FICO4	1.188	1.214	-2.1%
FICO5	0.973	0.992	-1.9%
FICO6	0.78	0.79	-1.3%
FICO7	0.503	0.519	-3.1%
LTV2	0.584	0.579	0.9%
LTV3	0.918	0.908	1.1%
LTV4	1.127	1.093	3.1%
LTV5	1.286	1.262	1.9%
LTV6	1.153	1.163	-0.9%
LTV7	1.393	1.379	1.0%
LTV8	1.589	1.57	1.2%
LTV9	1.329	1.339	-0.7%
LTV10	1.598	1.584	0.9%
LTV11	1.66	1.67	-0.6%
LTV12	1.671	1.631	2.5%
ARM	0.221	0.202	9.4%
GSE	-0.501	-0.621	-19.3%
X2006	0.454	0.316	43.7%
X2007	1.696	0.922	83.9%

Panel B: GSE Data Only

Parameter	SUW	Original	% Change
(Intercept)	-7.11244	-7.8442	-9.3%
FICO1	2.21849	2.22078	-0.1%
FICO2	1.84681	1.85245	-0.3%
FICO3	1.65195	1.64866	0.2%
FICO4	1.40496	1.40496	0.0%
FICO5	1.18779	1.18779	0.0%
FICO6	0.94169	0.94169	0.0%
FICO7	0.64515	0.64515	0.0%
LTV2	0.59479	0.59479	0.0%
LTV3	0.89583	0.89583	0.0%
LTV4	1.01667	1.01667	0.0%
LTV5	1.1627	1.1627	0.0%
LTV6	1.29551	1.29551	0.0%
LTV7	1.41574	1.41574	0.0%
LTV8	1.59166	1.59166	0.0%
LTV9	1.40797	1.40797	0.0%
LTV10	1.57989	1.57989	0.0%
LTV11	1.85743	1.85743	0.0%
LTV12	1.84999	1.76557	4.8%
ARM	0.25303	0.23896	5.9%
X2006	0.54657	0.04198	1202.0%
X2007	1.76232	0.73362	140.2%

Table 17: Panel A

	2003		2007	
	% of Loans	Default Rate	% of Loans	Default Rate
Fixed Rate	90.0%	2.5%	89.8%	13.3%
Prime	69.4%	0.7%	53.4%	2.9%
Risk Layered	2.3%	15.6%	6.2%	39.3%
LTV>90	8.5%	8.6%	19.6%	27.8%
FICO<660	12.1%	8.6%	16.7%	29.3%
ARM	10.0%	2.5%	10.2%	28.7%
Prime	7.4%	1.1%	7.3%	21.3%
Risk Layered	0.3%	12.0%	0.3%	57.2%
LTV>90	1.2%	6.1%	1.2%	46.9%
FICO<660	1.4%	7.1%	1.7%	48.1%
Total	100.0%	2.5%	100.0%	14.9%

Panel B:

2007 Book at 2003 Default Rates

Change	% of Loans	Default Rate
Fixed Rate		
Prime	53.4%	0.7%
LTV>90	19.6%	8.6%
FICO<660	16.7%	8.6%
ARM		
Prime	7.3%	1.1%
LTV>90	1.2%	6.1%
FICO<660	1.7%	7.1%
Default Rate		**3.79%**

2003 Book at 2007 Default Rates

Change	% of Loans	Default Rate
Fixed Rate		
Prime	69.4%	2.9%
LTV>90	8.5%	27.8%
FICO<660	12.1%	29.3%
ARM		
Prime	7.4%	21.3%
LTV>90	1.2%	46.9%
FICO<660	1.4%	48.1%
Default Rate		**10.74%**

Table 18

This table measures the actual hazard rate as calculated in (2) relative to the hazard rate predicted by the baseline model in Table 15 ***excluding*** the effect of indicator variables for vintage year.

	2001			2002		
	Total	FRM	ARM	Total	FRM	ARM
Hazard Rate	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Baseline	1.3%	1.3%	1.6%	1.2%	1.2%	1.6%
Price Impact	-1.0%	-1.0%	-1.2%	-0.8%	-0.8%	-1.1%
Unexplained	**0.0%**	**0.0%**	**-0.1%**	**0.0%**	**0.0%**	**-0.2%**

Average	Total	FRM	ARM
2001-2002	0.0%	0.0%	-0.2%

	2003			2004			2005		
	Total	FRM	ARM	Total	FRM	ARM	Total	FRM	ARM
Hazard Rate	0.4%	0.4%	0.4%	0.9%	0.9%	1.0%	2.0%	1.8%	3.1%
Baseline	1.1%	1.0%	1.4%	1.3%	1.2%	1.5%	1.3%	1.2%	1.5%
Price Impact	-0.7%	-0.7%	-0.9%	0.4%	0.4%	0.5%	1.4%	1.3%	1.7%
Unexplained	**0.0%**	**0.1%**	**-0.1%**	**-0.9%**	**-0.8%**	**-1.1%**	**-0.6%**	**-0.8%**	**0.0%**

Average	Total	FRM	ARM
2003-2005	-0.5%	-0.5%	-0.4%

	2006			2007			2008		
	Total	FRM	ARM	Total	FRM	ARM	Total	FRM	ARM
Hazard Rate	4.7%	3.9%	8.9%	8.0%	7.1%	16.9%	4.3%	4.2%	5.3%
Baseline	1.4%	1.3%	1.6%	1.5%	1.5%	1.7%	1.0%	1.0%	1.0%
Price Impact	2.5%	2.4%	3.0%	2.7%	2.7%	3.1%	0.6%	0.6%	1.5%
Unexplained	**0.8%**	**0.2%**	**4.3%**	**3.8%**	**3.0%**	**12.2%**	**2.8%**	**2.7%**	**2.8%**

Average:	Total	FRM	ARM
2006-2008	2.5%	2.0%	6.5%

Table 19

(Intercept)	-7.26.15	0.07994	-90.834	0.0000	***
FICO1	2.23074	0.03872	57.606	0.0000	***
FICO2	1.85855	0.03878	47.93	0.0000	***
FICO3	1.65253	0.03867	42.731	0.0000	***
FICO4	1.40496	0.03872	36.282	0.0000	***
FICO5	1.18779	0.03872	30.674	0.0000	***
FICO6	0.94169	0.03872	24.318	0.0000	***
FICO7	0.64515	0.03872	16.66	0.0000	***
LTV2	0.59479	0.04693	12.674	0.0000	***
LTV3	0.89583	0.04693	19.089	0.0000	***
LTV4	1.01667	0.04693	21.664	0.0000	***
LTV5	1.1627	0.04693	24.775	0.0000	***
LTV6	1.29551	0.04693	27.605	0.0000	***
LTV7	1.41574	0.04693	30.167	0.0000	***
LTV8	1.59166	0.04693	33.916	0.0000	***
LTV9	1.40797	0.04693	30.002	0.0000	***
LTV10	1.57989	0.04693	33.665	0.0000	***
LTV11	1.85743	0.04693	39.579	0.0000	***
LTV12	1.72503	0.05086	33.915	0.0000	***
Index	-3.68322	0.28254	-13.036	0.0000	***
UW	1.0755	0.12233	8.792	0.0000	***
ARM	0.14033	0.02082	6.74	0.0000	***
X2006	0.79419	0.03754	21.156	0.0000	***
X2007	1.14424	0.04722	24.233	0.0000	***
X2008	1.81596	0.0331	54.864	0.0000	***
interact07	0.73503	0.05805	12.662	0.0000	***